MERL-1467
Nikovski et al.

## Claims

We claim:

1     1. A method for scheduling a plurality of cars of an elevator system in a
2     building, comprising:
3          receiving a call;
4          determining, for each car, based on future states of the elevator system, a
5     first waiting time for all existing passengers if the car is assigned to service
6     the call;
7          determining, for each car, based on a landing pattern of the plurality of
8     cars, a second waiting time of future passengers if the car is assigned to
9     service the call;
10         combining, for each car, the first and second waiting times to produce an
11    adjusted waiting time; and
12         assigning a particular car having a lowest adjusted waiting time to service
13    the call and to minimize an average waiting time of all passengers.

1     2. The method of claim 1 wherein the existing passengers include riding
2     passengers in the plurality of cars having known arrival times, arrival floors,
3     and destination floors, waiting passengers assigned to the plurality of cars
4     having known arrival times, arrival floors and directions of travel, and a new
5     passenger signaling the call, and all passengers include the existing and
6     future passengers.

1     3. The method of claim 1 wherein the determining of the first waiting time
2     further comprises:

3    evaluating a cost function to determine a cost for each future state;

4    and

5    assigning a particular car associated with a set of states having a least

6    cost.



1    4. The method of claim 1 wherein a substantial number of the future

2    passengers arrive at a selected floor during an up-peak traffic period.



1    5. The method of claim 1 wherein the landing pattern of elevator cars at a

2    selected floor is a vector-valued random variable $\mathbf{T}$ with a probability

3    distribution $P(\mathbf{T})$, $\mathbf{T} \in T$ over a space of all possible landing patterns $T$.



1    6. The method of claim 5 wherein all possible landing patterns depend on

2    landing times of the plurality of cars.



1    7. The method of claim 1 determining the landing pattern for a near future

2    time interval.



1    8. The method of claim 8 wherein the near future time interval is an average

2    time it takes the plurality of cars to make a round trip from a main floor of

3    the building and back.



1    9. The method of claim 7 wherein the landing pattern for a far future time

2    interval $t$ is discounted by $\exp(-\beta t)$, where $\beta > 0$ is a discounting factor.



1    10. The method of claim 4 wherein future passengers arrive at the main floor

2    according to a Poisson process with a rate $\lambda$.


25

1   11. The method of claim 1 wherein the landing pattern is modeled by a semi-

2   Markov chain having a plurality of states and transitions.


1   12. The method of claim 1 wherein the first waiting time $W$ and second

2   waiting time $V$ are combined according to $\alpha W + (1-\alpha)V$, where $\alpha$ is a

3   weight in a range $0 \leq \alpha \leq 1$.


1   13. The method of claim 13 wherein an optimal weight $\alpha$ is in an interval

2   $[0.1, 0.3]$.


1   14. The method of claim 4 or 5, in which the selected floor is a main floor of

2   the building.


1   15. An elevator scheduler for scheduling a plurality of cars of an elevator

2   system in a building, comprising:

3       means for receiving a call;

4       means for determining, for each car, based on future states of the elevator

5   system, a first waiting time for all existing passengers if the car is assigned

6   to service the call;

7       means for determining, for each car, based on a landing pattern of the

8   plurality of cars, a second waiting time of future passengers if the car is

9   assigned to service the call;

10      combining, for each car, the first and second waiting times to produce an

11  adjusted waiting time; and

12      assigning a particular car having a lowest adjusted waiting time to service

13  the call and to minimize an average waiting time of all passengers.


26